ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

PG Curriculum and Syllabus

(1 to 4 Semesters)

MASTER OF COMPUTER APPLICATIONS

Choice Based Credit System (CBCS)

REGULATION 2020

ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

PG Curriculum and Syllabus

(1 to 4 Semesters)

MASTER OF COMPUTER APPLICATIONS (MCA)

Choice Based Credit System (CBCS)

(For the students admitted during the Academic year 2020-21 and onwards)

REGULATION 2020

ERODE SENGUNTHAR ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 057

INSTITUTION VISION & MISSION

VISION

Erode Sengunthar Engineering College strives with determination and commitment to provide and promote world-class Technical Education, in particular to the students of backward rural areas, transforming them into holistic personalities embedded with discipline, skill and responsibility that make them patriotic, successful, and self-developed professionals ready to accomplish any job in their career and life.

MISSION

- Provide an idyllic study atmosphere, fine infrastructure, qualified and dedicated faculty and standardized systems for a strong career foundation.
- Aid and motivate the students and faculty alike for maximum utilization of facilities, making them innovative and creative in thinking and research, in order to provide technical service to industry and society.
- Develop multi-skilled personalities to make ESEC, a world leader in Technical Education.

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

VISION

Enhance the IT knowledge & skill to meet the needs of industry, parents and society.

MISSION

- To make our students highly proficient in the fields of hardware, software and web technology
- To impart the significance of interdisciplinary domains for sustainable development
- To achieve employability by effectively developing their technical skills, communication skills and personality
- To groom the character with moral and ethical values and make them socially responsible

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To prepare students to excel in the computing profession by providing solid technical foundations in the field of computer applications.

II. To provide students various computing skills like the analysis, design and development of innovative software products to meet the industry needs.

III. To motivate students to pursue lifelong learning and do research as computing professionals and scientists.

IV. To motivate students to communicate and function effectively in teams in multidisciplinary fields within the global, societal and environmental context.

PROGRAMME OUTCOMES (POS):

On successful completion of the programme :

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of Mathematics, Natural sciences, and Engineering sciences.

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PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

P10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

P11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one"s own work, as a member and leader in a team to manage projects and in multidisciplinary environments.

P12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES (PSOs):

1. Enable the students to select the suitable data model, appropriate architecture and platform to implement a system with good performance.
2. Enable the students to design and integrate various system based components to provide user interactive solutions for various challenges.

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DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS (MCA)

REGULATIONS – 2020

CHOICE BASED CREDIT SYSTEM

I TO IV SEMESTERS CURRICULAM

MASTER OF COMPUTER APPLICATIONS

Minimum Credits to be Earned : 88

FIRST SEMESTER

Code No.	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
20CA101	Numerical Methods and Statistics	I,II,III	1,2,3	1,2	3	1	0	4	40	60	100	FC
20CA102	Database Management Systems	I,II,III	1,2,3	1,2	3	1	0	4	40	60	100	PC
20CA103	Data Structures and Algorithms	I,II,III	1,2,3,6,7	1	3	0	0	3	40	60	100	PC
20CA104	Object Oriented Programming	I,II,III	1,2,3,6	1,2	3	0	0	3	40	60	100	PC
20CA105	Computer Organization and Architecture	I,II,III	1,2,4	1,2	3	0	0	3	40	60	100	PC
20CAP01	Quantitative Aptitude and Logical Reasoning - I	I,II,III,IV	8,9,10,11	1,2	2	0	0	2	40	60	100	EEC
20CA111	Data Structures and Algorithms Laboratory	I,II,III	1,2,3,4,5	1	0	0	4	2	60	40	100	PC
20CA112	Database Management Systems Laboratory	I,II,III	1,2,3,4,5	1,2	0	0	4	2	60	40	100	PC
20CA113	Object Oriented Programming Laboratory	I,II,III	9,10	1,2	0	0	4	2	60	40	100	PC
Total					**17**	**2**	**12**	**25**	**420**	**480**	**900**	-

SECOND SEMESTER

Code No.	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSO					CA	ES	Total	
20CA201	Computer Networks	I,II,III	1,2,3	1	3	1	0	4	40	60	100	PC
20CA202	Principles of Operating Systems	I,II,III	1,2,3	1,2	3	0	0	3	40	60	100	PC
20CA203	Object Oriented Software Engineering	I,II,III	1,2,3	1	3	0	0	3	40	60	100	PC
20CA204	Statistical Computing with R Language	I,II,III	1,2,3,6	1,2	3	0	2	4	40	60	100	FC

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	Professional Elective–I				3	0	0	3	40	60	100	PE
20CAP02	Quantitative Aptitude and Logical Reasoning - II	I,II,III,IV	8,9,10,11	1,2	2	0	0	2	40	60	100	EEC
20CA211	Scripting Laboratory	I,II,III	1,2,3,4,5	1	0	0	4	2	60	40	100	PC
20CA212	Computer Networks Laboratory	I,II,III	1,2,3,4,5	1,2	0	0	4	2	60	40	100	PC
20CA213	Object Oriented Software Engineering Laboratory	I,II,III	1,2,3,4,5	1	0	0	4	2	60	40	100	PC
Total					**17**	**1**	**14**	**25**	**420**	**480**	**900**	-

THIRD SEMESTER

Code No.	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
20CA301	Mobile Application Development	I,II,III	1,2,3	1,2	3	1	0	4	40	60	100	PC
20CA302	AI and Machine Learning	I,II,III	1,2,3	1	3	1	0	4	40	60	100	PC
20CA303	Internet of Things	I,II,III	1,2,3	1,2	3	0	0	3	40	60	100	PC
	Professional Elective–II				3	0	0	3	40	60	100	PE
	Professional Elective–III				3	0	0	3	40	60	100	PE
20CAP03	Soft Skills	I,II,III,IV	8,9,10,11	1,2	1	0	2	3	40	60	100	EEC
20CA311	Mobile Application Development Laboratory	I,II,III	1,2,6,12	1	0	0	4	2	60	40	100	PC
20CA312	Internet of Thinks Laboratory	I,II,III	1,2,4,10	1	0	0	4	2	60	40	100	PC
20CA313	Mini Project	I,II,III	1,2,10, 12	1,2	0	0	4	2	60	40	100	EEC
Total					**17**	**2**	**12**	**25**	**420**	**480**	**900**	-

FOURTH SEMESTER

Code No.	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
20CA411	Project Work	I,II,III,IV	8,9,10,11	1,2	0	0	24	12	60	40	100	EEC
Total					**0**	**0**	**0**	**12**	**60**	**40**	**100**	-

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ELECTIVES								
Code No.	Course	Objectives & Outcomes			L	T	P	C
		PEOs	POs	PSOs				
ELECTIVE-I								
20CAE01	Software Testing and Quality Assurance	I,II,III	1,2,6,12	1,2	3	0	0	3
20CAE02	Data Warehousing and Data Mining	I,II,III	1,2,6,12	1,2	3	0	0	3
20CAE03	Digital Image Processing	I,II,III	1,2,6,12	1,2	3	0	0	3
20CAE04	Middleware Technologies	I,II,III	1,2,6,12	1,2	3	0	0	3
20CAE05	Mobile Computing	I,II,III	1,2,6,12	1,2	3	0	0	3
ELECTIVE-II								
20CAE06	Supply Chain Management	I,II,III	1,2,4,6	1,2	3	0	0	3
20CAE07	Human Resource Management	I,II,III	1,2,4,6	1,2	3	0	0	3
20CAE08	Management Information Systems	I,II,III	1,2,4,6	1,2	3	0	0	3
20CAE09	Professional Ethics	I,II,III	1,2,4,6	1,2	3	0	0	3
20CAE10	Enterprise Resource Planning	I,II,III	1,2,4,6	1,2	3	0	0	3
ELECTIVE-III								
20CAE11	Service Oriented Architecture	I,II,III	1,2,9,12	1	3	0	0	3
20CAE12	Cloud Computing and Big Data Analytics	I,II,III	1,2,9,12	1	3	0	0	3
20CAE13	Database Tuning	I,II,III	1,2,9,12	1	3	0	0	3
20CAE14	Software Reliability Engineering	I,II,III	1,2,9,12	1	3	0	0	3
20CAE15	Block Chain Technology	I,II,III	1,2,9,12	1	3	0	0	3

SUMMARY OF CREDIT DISTRIBUTION

S.No.	CATEGORY	CREDITS PER SEMESTER				TOTAL CREDIT	CREDITS in %	Range of Total Credits	
		I	II	III	IV			Min %	Max %
1	FC	04	04	-	-	08	09	08	15
2	PC	19	16	15	-	50	57	55	65
3	PE	-	03	06	-	09	10	10	15
4	EEC	02	02	05	12	21	24	15	25
Total		25	25	26	12	88	100	-	-

FC - Foundation Course
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course
CA - Continuous Assessment
ES - End Semester Examination

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	FC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA101	NUMERICAL METHODS AND STATISTICS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- By enrolling and studying this course the students will be able to understand the methods to solve polynomial equations and Implement the mathematical ideas for interpolation numerically
- Summarize and apply the methodologies involved in solving problems related to ordinary and partial differential equations
- Develop the art of correlating the data and analyze the data using variance
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

Course Outcomes: At the end of this course, learners will be able to:

- Classify the equations into algebraic, transcendental or simultaneous and apply the techniques to solve them numerically
- Demonstrate and obtain the differentiation and integration of functions using the numerical techniques
- Obtain the solutions of all types of differential equations, numerically.
- Apply Correlation and Regression to predict the relevant outcome in real life.
- Design an experiment for an appropriate situation using ANOVA technique.

Unit I	SOLUTION OF EQUATIONS	12

Solution of algebraic and transcendental equations: Newton- Raphson method - Solution of system of linear equations: Gauss elimination method - Inverse of a matrix: Gauss-Jordan method- Power method.

Unit II	NUMERICAL DIFFERENTIATION AND INTEGRATION	12

Interpolation: Newton's forward and backward interpolation formulae - Numerical differentiation: Newton's forward and backward interpolation formulae. Numerical integration: Trapezoidal rule- Simpson's1/3 rule for single integrals- Two point Gaussian quadrature formula.

Unit III	NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS	12

Solution of first order ordinary differential equations: Fourth order Runge- Kutta method - Solution of partial differential equations: Elliptic equations: Poissons equation- Parabolic equations by Crank Nicholson method- Hyperbolic equations by explicit finite difference method

Unit IV	CORRELATION AND REGRESSION	12

Correlation- Multiple correlation –Regression – Multiple Regression-Linear fit- Quadratic fit

Unit V	DESIGN OF EXPERIMENTS	12

Completely randomized design - Randomized block design - Latin square design.

REFERENCE(S):

1. Steven Chapra , Numerical Methods for Engineers , Tata McGraw Hill seventh Edition, 2015.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3. Walpole R.E, Myers R.H, Myers R.S.L and Ye K, Probability and Statistics for Engineers and Scientists, Seventh Edition, Pearsons Education, Delhi, 2002
4. Burden R. L and Douglas Faires J, Numerical Analysis Theory and Applications, CengageLearning, Ninth Edition, 2005.
5. Gerald C. F and Wheatley P.O, Applied Numerical Analysis, Seventh Edition, Pearson Education, New Delhi, 2004.
6. Johnson R.A, Miller and Freund, Applied Probability and Statistics for Engineers, Seventh Edition, Prentice Hall of India, New Delhi, 2005.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA102	DATABASE MANAGEMENT SYSTEMS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is

- To understand basic database concepts, including the structure and operation of the relational data model and advanced database concepts.
- To know the database transaction and related database facilities, including concurrency control, backup and recovery and data object locking and protocols.
- To construct simple and moderately advanced database queries using SQL

Course Outcomes: At the end of this course, learners will be able to:

- Understand about the Relational Database
- Know about the Database Design
- Know about the Transaction
- Know about the storage of internals
- Understand about the Advanced DBMS

UNIT I	RELATIONAL DATABASES	12

Purpose of Database System – View of Data – Data Models – Database System Architecture – Introduction to Relational Databases - The Relational Model – Keys – Introduction to SQL – Intermediate SQL- Advanced SQL – Embedded SQL – Dynamic SQL - Entity Relationship Model – E-R Diagrams.

UNIT II	DATABASE DESIGN	12

Non-loss Decomposition – First Normal Form – Functional Dependencies - Second - Third Normal Forms - Dependency Preservation – Boyce/Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III	TRANSACTIONS	12

Transaction Concepts - ACID Properties – Serializability – Concurrency Control – Lock-Based Protocols – Two Phase Locking – Deadlock Handling – Recovery System – Failure Classification – Recovery and Atomicity – Recovery Algorithms – Transaction Rollback – Recovery after a System Crash – Early Lock Release and Logical Undo Operations.

UNIT IV	CPU ORGANISATION	12

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing.

UNIT V	ADVANCED TOPICS	12

Distributed Databases – Homogeneous and Heterogeneous Databases – Distributed Data Storage - Distributed Transactions – Commit Protocols - Two-phase Commit, Three-phase Commit – Cloud based databases - XML Databases – Structure - Querying and Transformation - Tree Model - XPath - Storage of XML data - SQL/XML.

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TEXT BOOK(S):	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", McGraw Hill, 6th Edition, 2011.
2.	C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems",P.E.2006.
REFERENCE(S):	
1.	RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", P.E., 2008.
2.	Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata McGraw, 2010
3.	Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/106106095/, "Introduction to Database Systems and Design, Prof. P.Sreenivasa Kumar, IIT Madras.
2.	http://nptel.ac.in/courses/106106093/, "Database Design", Prof. D. Janaki Ram

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Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA103	DATA STRUCTURES AND ALGORITHMS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To understand linear and non-linear data structures available in solving problems
- To classify different sorting and searching techniques and its efficiencies
- To apply data structures and algorithms in real time applications

Course Outcomes: At the end of this course, learners will be able to:

- Know about the Basic Types of Data Structures
- Understand about the TREES
- Apply the Knowledge of Sorting and Hashing
- Know the applications of Graphs
- Understand about the storage management

UNIT I	LIST, STACK AND QUEUE	9

Introduction - Abstract Data Types (ADT) – The List ADT – The Stack ADT – The Queue ADT

UNIT II	TREES	9

Preliminaries – Binary Trees- Binary Search Trees- AVL Trees – Splay Trees – B- Trees - Threaded Trees

UNIT III	SORTING AND HASHING	9

Sorting – Preliminaries – Insertion Sort – Shell Sort - Heap sort – Merge sort – Quick sort- External Sorting - Hashing.

UNIT IV	GRAPHS & THEIR APPLICATIONS	9

Definitions – Graph Traversals - Topological Sort – Shortest-Path Algorithms – Network Flow Problems – Minimum Spanning Tree- Application of Depth First Search.

UNIT V	STORAGE MANAGEMENT	9

General Lists – Automatic List Management – Dynamic Memory Management.

TEXT BOOK(S):

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", P.E. Asia, 2011.
2. YedidyahLangsam, Moshe.J.Augenstein Aaron M. Tenenbaum, "Data Structures using C and C++" P.E., 2004.

REFERENCE(S):

1. Horowitz, Sahni and Anderson Freed, "Fundamentals of Data structures in C", University Press, 2011.
2. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", P.E, 2002.
3. Jean-Paul Tremblay, Paul.G.Sorenson, "An introduction to Data Structures with Applications", Tata McGraw-Hill Education, Second Edition, 2001.

WEB RESOURCE(S):

1. https://www.youtube.com/results?search_query=data+sructures+IIT
2. https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA104	OBJECT ORIENTED PROGRAMMING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To comprehend and use the fundamentals of object oriented programming in JAVA
- To Design and implement reliable and maintainable object-oriented applications of moderate complexity composed of several classes
- To describe the java internals and Networks

Course Outcomes: At the end of this course, learners will be able to:

- Understand the Concept of Java Fundamentals
- Apply the knowledge of Java Collections
- Know the basic concepts of Advanced Java Programming
- Understand the Java Enterprise Application
- Understand about Internals of Java

UNIT I	JAVA FUNDAMENTALS	9

Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes, Methods – Inheritance – Packages and Interfaces – Boxing, Unboxing – Variable-Length Arguments (Varargs), Exception Handling

UNIT II	COLLECTIONS AND ADVANCE FEATURES	9

Utility Packages- Introduction to collection –Hierarchy of Collection framework – Generics, Array list, LL, HashSet, Treeset, HashMap – Comparators – Java annotations – Premain method.

UNIT III	ADVANCED JAVAPROGRAMMING	9

Input Output Packages – Inner Classes – Java Database Connectivity – Introduction JDBC Drivers – JDBC connectivity with MySQL/Oracle –Prepared Statement & Result Set – JDBC Stored procedures invocation – Servlets – RMI – Swing Fundamentals – Swing Classes.

UNIT IV	OVERVIEW OF DATA RETRIEVAL &ENTERPRISE APPLICATION DEVELOPMENT	9

Tiered Application development – Java Servers, containers –Web Container – Creating Web Application using JSP/Servlets – Web Frameworks- Introduction to Spring/ Play Framework – ORM Layer – Introduction to Hibernate.

UNIT V	JAVA INTERNALS AND NETWORKING	9

Java jar Files-Introspection – Garbage collection – Architecture and design – GC Cleanup process, Invoking GC, Generation in GC – Networking Basics Java and the Net – Inet Address – TCP/IP Client Sockets – URL –URL Connection – TCP/IP Server Sockets – A Caching Proxy HTTP Server – Datagrams.

TEXT BOOK(S):

1. Amritendu De, "Spring 4 and Hibernate 4: Agile Java Design and Development", McGraw-Hill Education,2015.
2. Herbert Schildt, The Complete Reference – Java 2, Ninth Edition, Tata McGraw Hill, 2014.

REFERENCE(S):

1. Mahesh P. Matha, "Core Java A Comprehensive Study", Prentice Hall of India, 2011
2. R. Nageswara Rao, "Core Java: An Integrated Approach", DreamTech Press, 2016
3. Paul Deitel, Harvey Deitel, —Java SE 8 for programmersll, 3rd Edition, Pearson, 2015.

WEB RESOURCE(S):

1. http://nptel.ac.in/courses/106105151/, "Programming in Java ", Prof. ParthaPratim Das IIT Kharagpur.

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA105	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To identify the basic concepts of computer architecture and organization.
- To articulate design issues in the development of processor or other components that satisfy design requirements.
- To Know about the Input and Output Organization.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basic concepts of Digital System
- Understand the Data Formats
- Understand the Register and Micro Operations
- Know the Working Principles of CPU Organization
- Understand the Input and Output Organization and Memory Organization

UNIT I	DIGITAL LOGIC CIRCUITS	9

Digital computer - Logic gates- Boolean Algebra - Simplification of Boolean functions: Boolean laws and postulates, Karnaugh's Map method. Combinational circuits: Half-Adder, Full-Adder – Subtractor - Design of Combinational Circuits. Sequential circuits: Basic concepts: Clocks - Flip-Flops: SR-F/F, D-F/F, JK-F/F, T-F/F- Edge-triggered Flip-flop.

UNIT II	DIGITAL COMPONENTS & DATA FORMATS	9

Integrated Circuits – Decoders – Encoders – Multiplexers – DeMultiplexers – Registers – Shift registers – Binary Counters Data formats: Introduction - Number Systems – Number Bases – Arithmetic – Number Base conversion - Alphanumeric character data – Other Binary codes. Internal Computer Data formats: Representing Integer Data – Complements – (r-1)'s, r's – Floating Point Representation.

UNIT III	REGISTER TRANSFER AND MICROOPERATIONS	9

Bus and Memory Transfer - Tri-state buffers - Arithmetic, Logic, Shift Micro-operations – Arithmetic Logic Shift Unit. Basic computer design: Stored Program Organization – Computer Registers – Computer Instructions - Timing and Control: Instruction Cycle - Memory Reference Instructions – Input-Output and interrupt cycle – Introduction to Micro programmed Control Unit.

UNIT IV	CPU ORGANISATION	9

General Register Organization – Stack Organization - Instruction formats – Types of Interrupts – Addressing modes – Data Transfer & Manipulation – Program Control. Parallel Processing: Parallel Processing – Pipelining – Array Processors – Superscalar Processors

UNIT V	INPUT AND OUTPUT ORGRANIZATION & MEMORY ORGANIZATION	9

Input and Output interface – Asynchronous Data transfer – Modes of Transfer – DMA – I/O processor. Memory organization: Types of Memory - Memory Hierarchy- Main Memory- Associative Memory - Cache Memory – Virtual Memory: Address mapping using pages.

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TEXT BOOK(S):	
1.	Morris Mano M, "Computer System Architecture", Third Edition, Prentice Hall of India Pvt Ltd, 2003.
2.	Malvino A.P and Donald P. Leach, "Digital Principles and Applications", Tata McGraw Hill, 2002.
REFERENCE(S):	
1.	John P. Hayes, "Computer Architecture and Organization", McGraw Hill, 2003.
2.	William Stallings, "Computer Organization and Architecture: Designing for Performance", Prentice Hall, 2001.
3.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/106103068/" Computer Organization and Architecture", Prof. Jatindra Kumar Deka, IIT Guwahati.
2.	http://nptel.ac.in/courses/106104122/"Computer Organization", Prof.Mainak Chaudhuri, IIT Kanpur.

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Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAP01	Quantitative Aptitude and Logical Reasoning - I	2	0	0	2	30	100	

Course Objective (s):

- To learn the basic of ratio and proportion.
- To calculate different ways of solving problems on ages and chain rule.
- To grasp average and percentage concepts through shortcuts.
- To know about coding and decoding through logical way.
- To learn the logical skills by analyzing the objects.

Course Outcomes: At the end of this course, learners will be able to:

- Solve most of the aptitude topics by knowing ratio and proportion topics.
- Solve the problems on ages by using logical way of approach.
- Calculate percentages and averages in real life contexts.
- Enhance the logical way of thinking by solving problems codes and rankings concepts.
- Develop their logical thinking.

UNIT 1	Ratio & Proportion	6

Ratio And Proportion: Ratio between two or more persons – Miscellaneous problems.

UNIT 2	Problem On Ages & Chain Rule	6

Problems On Ages: Ages - Persons in Past - Present - Future. Miscellaneous problem.
Chain Rule: Definition – Direct proportion and Indirect proportion.

UNIT 3	Averages & Percentage	6

Averages: Average from total –Total from the average – Miscellaneous problems.
Percentage: Percentage – Percentage using shortcuts.

UNIT 4	Logical Sequence Of Word, Coding And Decoding, Number Ranking & Time Sequence Test	6

Logical Sequence Of Words: Sequence of occurrence of events – Sequence of objects in a class or group – Sequence of increasing/decreasing size, value, intensity, etc.
Coding And Decoding: Introduction – Description of coding method, Coding patterns – Concepts of coding & decoding – Problems involving coding & decoding method.

Number Rankings & Time Sequence Test: Number test – Ranking test – Time sequence test.

UNIT 5	Analogy & Spotting The Error	6

Analogy : Objectives – 8 Vital Templates of Analogies - Types .
Spotting The Error: Basic Grammar – Rules of Grammar – Subject Verb Agreement – Parts of Speech – Objectives of Error Spotting – Types of Error Spotting.

TOTAL : 30 HOURS

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REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA111	DATA STRUCTURES AND ALGORITHMS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To analyze the Data Structure
- To design and Implement the Stack and Queue
- To expose the students to do experiment on Search Methods
- To implement the Sorting methods
- To learn about Spanning Tree and Shortest path algorithms

Course Outcomes: At the end of this course, learners will be able to:

- Illustrate the Stack Programs
- Explore the Linked List
- Build a Sorting Programs .
- Determine the Searching Methods.
- Study and understand the operation of Shortest Path Algorithm.

Exp No.	Name of Experiments
1	Stack: Implementation using arrays and lists
2	Queue: Implementation using arrays and lists
3	Singly Linked List operations
4	Doubly Linked List operations
5	Sorting
6	Expression Evaluation
7	Binary Search Tree: Implementation with insertion, deletion and Traversal
8	Graph Traversals - DFS and BFS.
9	Minimum Spanning Tree
10	Implementation of Shortest Path Algorithms

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. C Compiler - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
20CA112	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C	60	100	
		0	0	4	2			

Course Objective (s): The purpose of learning this course is

- To know about the DBMS Structure
- To design and Implement the Basic Query Languages
- To understand about the High Level Programming Languages
- To programming using menus
- To learn about Database Design and Implementation

Course Outcomes: At the end of this course, learners will be able to:

- Creating Database for all kind of applications
- Awareness about SQL Commands
- Build a Forms and Triggers
- Know about the Reports.
- Study and understand the creation of package

Exp No.	Name of Experiments
1	Data Definition, Table Creation, Constraints
2	Insert, Select Commands, Update & Delete Commands.
3	Nested Queries & Join Queries
4	Views
5	High level programming language extensions (Control structures, Procedures and Functions)
6	Front end tools
7	Forms & Triggers
8	Menu Design
9	Reports
10	Database Design and implementation
11	Creation of a package by effectively using all the facilities existing in RDBMS

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. Java / PHP / MYSQL - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester I	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
20CA113	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C	60	100	
		0	0	4	2			

Course Objective (s): The purpose of learning this course is

- To understand the concept Object Oriented Programming
- To design and Implement the basic Java Programs
- To expose the students to do Exception Handling
- To implement the Network Programming
- To learn about Applet methods

Course Outcomes: At the end of this course, learners will be able to:

- Explore the basic Java Programs
- Explore the Java Package
- Build the Exception Programs
- Determine the Multithreading
- Study and Program the Applet Methods

Exp No.	Name of Experiments
1	Program to define a structure of a basic JAVA program
2	Program to define the data types, variable, operators, arrays and control structures.
3	Program to define class and constructors. Demonstrate constructors.
4	Program to define class, methods and objects. Demonstrate method overloading.
5	Program to define inheritance and show method overriding.
6	Program to demonstrate Packages
7	Program to demonstrate Exception Handling.
8	Program to demonstrate Multithreading.
9	Program to demonstrate I/O operations.
10	Program to demonstrate Network Programming.
11	Program to demonstrate Applet structure and event handling.
12	Program to demonstrate Layout managers.

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. Java / MS Acess/ MySQL, NET Beans / TOMCAT Server - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA201	COMPUTER NETWORKS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is

- The students will be able to build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to advanced networking concepts, preparing the student for entry advanced courses in computer networking.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the fundamental underlying principles of computer networking.
- Understand details and functionality of layered network architecture.
- Have a good understanding of the OSI Reference Model and in particular have a good knowledge of Layers 1-3.
- Knowledge about the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.
- Understand the main protocols such as HTTP, FTP, SMTP, TCP, UDP, IP.

UNIT I	INTRODUCTION	12

Introduction– Computer Networks – Network For Companies – Network For People – Application – Network Hardware–LAN, WAN, MAN, Wireless Networks–Network Software – Protocol Hierarchies – Reference Model–OSI Reference model, TCP/IP Reference – Comparison of OSI & TCP/IP.

UNIT II	TYPES OF LAYERS	12

The Internet – The ARPANET–NSFNET–Internet Usage– Architecture Of Internet– Connection Oriented Network X.25, Frame relay–ATM–ATM Virtual Circuits–ATM Reference Model –Guided Transmission Media – Magnetic Media – Twisted Pair – Coaxial Cable – Fibre Optics – Wireless Transmission – Data Link Layer – Data Link Layer Design Issues.

UNIT III	TYPES OF PROTOCOLS	12

Public Switched Telephone Network–Structure Of Telephone System–Switching–Elementary Data Link Protocols–An Unrestricted Simplex Protocol–A Simplex Stop And Wait Protocol–A Simplex Protocol For A Noisy Channel–Sliding Window Protocols–One Bit Sliding Window Protocol–A Protocol Using Go Back N–A Protocol Using Selective Repeat.

UNIT IV	ROUTING ALGORITHMS	12

The Network Layer – Design Issues – Routing Algorithm – The Optimality Principle – Shortest Path Routing – Flooding – Distance Vector Routing – Hierarchical Routing – Link State Routing – Broad Cast Routing – Multicast Routing – Congestion Control Algorithm – General Principle Of Congestion Control – Congestion Prevention Policies – Congestion Control In Virtual Circuit Subnets – Congestion Control In Datagram Subnets – Load Scheduling – Jitter Control.

UNIT V	TRANSPORT LAYER	12

Transport Layer – Design Issues – Elements Of Transport Protocols – Addressing – Connection Establishment – Connection Release – The Internet Transport Protocol – Network Security – Cryptography.

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TEXT BOOK(S):	
1.	1. S.Tanenbaum, "Computer Networks", Pearson Education, Inc, New Delhi, Fourth Edition, 2003.
2.	Robert W Sebesta, "Concepts of Programming Languages", Addison Wesley, 2008
REFERENCE(S):	
1.	B. Forouzan, "Introduction to Data Communications in Networking", Tata McGraw Hill, New Delhi, 2007.
2.	. F. Halsall, "Data Communications, Computer Networks and Open Systems", Addison Wessley,
3.	Bertsekas and R. Gallagher, "Data Networks", Prentice hall of India, New Delhi, 2012.
WEB RESOURCE(S):	
1.	https://www.youtube.com/results?search_query=Programming+Principles+IIT
2.	https://www.youtube.com/results?search_query=C+Programming++IIT

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA202	PRINCIPLES OF OPERATING SYSTEMS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To identify the operating system components and its services
- To categorize the algorithms in process management and solving the issues of IPC
- To describe the file handling concepts in OS perspective.

Course Outcomes: At the end of this course, learners will be able to:

- Apply the Concept of Process management in OS
- Apply the knowledge of Memory Management
- Know the basic concepts of Distributed OS
- Understand the Fault Tolerance
- Understand about Mobile OS

UNIT I	PROCESS MANAGEMENT	9

Introduction, Processes : Process concept – Process Scheduling - Cooperating Processes - Interprocess communication, Threads, CPU Scheduling: Concepts – Scheduling criteria - Scheduling algorithms - Process Synchronization: Background - Critical-Section problem – Semaphores - Classic Problem of synchronization - Critical Region – Monitors

UNIT II	MEMORY MANAGEMENT	9

Background - Swapping - Contiguous Memory Allocation – Paging - Segmentation, Virtual Memory: Background - Demand Paging - Page Replacement - Allocation of Frames - Thrashing

UNIT III	DISTRIBUTED OPERATING SYSTEM	9

Definition of Distributed System – Communication: RPC, Remote Method Invocation –Message and Stream Orient Communication - Processes: Threads – Naming: Naming Entities –Synchronization: Clock Synchronization, Logical Clocks, Global State, Election Algorithms and Mutual Exclusion.

UNIT IV	REPLICATION AND FAULT TOLERANCE	9

Introduction to Replication – Consistency Models: Data Centric Consistency models, Client Centric Consistency models – Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Distributed Commit and Recovery.

UNIT V	REAL TIME AND MOBILE OPERATING SYSTEMS	9

Basic Model of Real Time Systems – Characteristics - Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

TEXT BOOK(S):

1. Silberschatz and Galvin, "Operating System Concepts", John Wiley & Sons, Inc., 8th Edition, 2008.
2. Rajib Mall, "Real - Time Systems: Theory and Practice", Pearson Education India, 2006.

REFERENCE(S):

1. P.C.Bhatt, "An Introduction to Operating Systems–Concepts and Practice", Prentice Hall of India, 2010.
2. H.M.Deitel, "An Introduction to Operating Systems", Pearson Education, 3rd Edition, 2003.
3. MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw - Hill, 2001.

WEB RESOURCE(S):

1. http://www.nptel.ac.in/downloads/106108101/, "Operating Systems", Prof. P.C.P. Bhatt, IISc Bangalore.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA203	OBJECT ORIENTED SOFTWARE ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge on object-oriented analysis in software process
- To expose case studies based project specifications to build up object-oriented models and identify implementation strategies.
- To develop the understanding of basic object oriented techniques to create and modify object-oriented analysis and design models.
- To gain the knowledge over testing techniques for object oriented software.

Course Outcomes: At the end of this course, learners will be able to:

- Able to understand the object oriented concepts and to apply object oriented life cycle model for a project
- Able to design static and dynamic models using UML diagrams
- Able to perform object oriented analysis to identify the objects from the problem specification
- Able to identify and refine the attributes and methods for designing the object oriented system.

UNIT I	INTRODUCTION	09

An overview – Object basics – Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.

UNIT II	METHODOLOGY AND UML	09

Introduction – Survey – Rumbugh, Booch, Jacobson methods – Patterns – Frameworks – Unified approach – Unified modeling language – Static and Dynamic models – UML diagrams – Class diagram – Use case diagrams – Dynamic modeling – Model organization – Extensibility.

UNIT III	OBJECT ORIENTED ANALYSIS	09

Identifying Use case – Business object analysis – Use case driven object orientedanalysis – Use case model – Documentation – Classification – Identifying object,relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility.

UNIT IV	OBJECT ORIENTED DESIGN	09

Design process – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface.

UNIT V	QUALITYAND TESTING	09

Quality assurance – Testing strategies – Object orientation testing – Test cases – Test Plan – Debugging principles – Usability – Satisfaction – Usability testing – Satisfaction testing.

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TEXT BOOK(S):
1.Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, 1999.
2.Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley Long man, 1999.
REFERENCE(S):
1.Craig Larman, Applying UML and Patterns, 2nd Edition, Pearson, 2002.
2.Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2004.
WEB RESOURCE(S):
1.http://nptel.ac.in/syllabus/106106110/, "Object Computing", Dr. R. Nadarajan, PSG College of Technology, Coimbatore
2.http://dos.iitm.ac.in/OOSD_Material/, "NPTEL Course Material on "UML applications", Prof. Rajeev Kumar, IIT Madras.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	FC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA204	STATISTICAL COMPUTING WITH R LANGUAGE	3	0	1	4	60	100	

Course Objective (s): The purpose of learning this course is

- To expose the students to the fundamentals of R Programming Language
- To impart knowledge on Statistical calculations in R language
- To introduce the development of statistical test cases

Course Outcomes: At the end of this course, learners will be able to:

- List motivation for learning a programming language
- Access online resources for R and import new function packages into the R workspace
- Import, review, manipulate and summarize data-sets in R
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- Perform appropriate statistical tests using R Create and edit visualizations

UNIT I	INTRODUCTION	12

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II	R PROGRAMMING STRUCTURE	12

R Programming Structures, Control Statements, Loops, – Looping Over Non vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quick sort Implementation-Extended Extended Example: A Binary Search Tree.

UNIT III	SIMULATION IN R	12

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV	STATISTICS INTRODUCTION	12

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

UNIT V	LINEAR MODELS AND LINEAR REGRESSION	12

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, – Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests.

TEXT BOOK(S):

1. Peter Dalgaard, "Introductory Statistics with R (Statistics and Computing) ", Springer, 2004.
2. Torsten Horthron, A Handbook of Statistical Analyses using R, CRC Press, 2014.

REFERENCE(S):

1. The Art of R Programming, Norman Matloff, Cengage Learning
2. Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill International, Auckland.
3. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", 2015.

WEB RESOURCE(S):

1. https://drive.google.com/file/d/10bnURD8ICZ2VDWanHc3_h00OSKsy-MtF/view
2. https://drive.google.com/file/d/18GpJc072POdzcpfRwfGgwJ2fGb_hYW5p/view

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAP02	Quantitative Aptitude and Logical Reasoning - II	2	0	0	2	30	100	

Course Objective (s):

- To learn the basic of numbers and partnership in simplified way.
- To solve problems using fast track method by learning profit and loss.
- To teach the numbers systems concepts in fast pace.
- To know the relationship, direction concepts in easy way.
- To teach seating arrangements in rows or in small groups.

Course Outcomes: At the end of this course, learners will be able to:

- Perform arithmetical operations with complex numbers and Data analysis.
- Know the tips and tricks of profit and loss through fast track methods.
- Develop the student's mental ability of solving aptitude through number systems and speed maths concepts.
- Evaluate critically the real life situations by resorting and analyzing analytical reasoning of key issues and factors.
- Analyze the conditions and do interpretation.

UNIT 1	Partnership & Problems On Numbers	6

Partnership: Ratio of division of gains: Simple Partnership – Compound Partnership - Working and sleeping partners.
Problems On Numbers: Set of numbers – Assume the unknown numbers and form equations.

UNIT 2	Height And Distance, Profit & Loss	6

Height And Distances: Line of sight – Angle of elevation – Angle of depression.
Profit And Loss: Basic definition and types of profit and loss – Concept of discount and marked price – Concept of true v/s false value – Application in data interpretation problems.

UNIT 3	Number Systems	6

Number Systems: Numbers and types of Numbers – Properties of Numbers –Face value and place value - Divisibility rules – Concept on unit digit and remainder theorem.

UNIT 4	Blood Relationship,Statement & Assumption,Situation Reaction Test & Direction Sense Test	6

Blood Relationship: Analysis the gender relationship –Relationship diagram - Family tree.
Statement and Assumption, Situation Reaction Test.
Direction Sense Test: Distance between the starting and ending points - Sense the direction correctly.

UNIT 5	Seating Arrangements & Data Sufficiency	6

Seating Arrangements: Persons seating in the circular – Rectangular – Square.
Data Sufficiency: Reasoning ability using a set of directions.

TOTAL : 30 HOURS

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REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA211	SCRIPTING LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To develop the understanding of different scripting Language.
- To familiarize with programming environment used to develop applications.
- To teach the concepts of java and VB script.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstration of HTML code and add script.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends scripting.
- Learned about statistical applications

Exp. No.	Name of Experiments
1.	Write an HTML code to display your education details in a tabular format.
2.	Write an HTML code to display your CV on a web page.
3.	Write an HTML code to create a Home page having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.
4.	Write an HTML code to create a login form. On submitting the form, the user should get navigated to a profile page.
5.	Write an HTML code to create a Registration Form. On submitting the form, the user should be asked to login with this new credentials.
6.	Write an HTML code to create your Institute website, Department Website and Tutorialwebsite for specific subject.
7.	Write an HTML code to illustrate the usage of the following: • Ordered List • UnorderedList • Definition List
8.	Write an HTML code to create a frameset having header, navigation and contentsections.
9.	Write an HTML code to demonstrate the usage of inline CSS.
10.	Write an HTML code to demonstrate the usage of internal CSS.
11.	Write an HTML code to demonstrate the usage of external CSS.
12.	Write a Java script to prompt for users name and display it on the screen.

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. HTML Interpreter - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA212	COMPUTER NETWORKS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To analyze the Network concepts
- To design and Implement the TCP/IP and UDP
- To expose the students to do experiment on protocols.

Course Outcomes: At the end of this course, learners will be able to:

- Implement various protocols using TCP and UDP.
- Compare the performance of different transport layer protocols.
- Use simulation tools to analyze the performance of various network protocols.
- Analyze various routing algorithms.
- Implement error correction codes.

Exp No.	Name of Experiments
1	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2	Write a HTTP web client program to download a web page using TCP sockets.
3	Applications using TCP sockets like: a) Echo client and echo server b) Chat c) File Transfer
4	Simulation of DNS using UDP sockets.
5	Write a code simulating ARP /RARP protocols
6	Study of Network simulator (NS) and Simulation of Congestion Control Algorithmsusing NS
7	Study of TCP/UDP performance using Simulation tool.
8	Simulation of Distance Vector/ Link State Routing algorithm.
9	Performance evaluation of Routing protocols using Simulation tool.
10	Simulation of error correction code (like CRC).

Software Requirements (for a batch of 30 Students)

-

1. Computers - 30 Nos
2. C / C++ / Java / Python / Equivalent Compiler - 30 Nos.
3. Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalent

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA213	OBJECT ORIENTED SOFTWARE ENGINEERING LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To understand the concept Object Oriented Programming
- To design and Implement the basic Java Programs
- To expose the students to do Exception Handling
- To implement the Network Programming
- To learn about Applet methods

Course Outcomes: At the end of this course, learners will be able to:

- Explore the basic Java Programs
- Explore the Java Package
- Build the Exception Programs
- Determine the Multithreading
- Study and Program the Applet Methods

Exp No.	Name of Experiments
1	Program to define a structure of a basic JAVA program
2	Program to define the data types, variable, operators, arrays and control structures.
3	Program to define class and constructors. Demonstrate constructors.
4	Program to define class, methods and objects. Demonstrate method overloading.
5	Program to define inheritance and show method overriding.
6	Program to demonstrate Packages
7	Program to demonstrate Exception Handling.
8	Program to demonstrate Multithreading.
9	Program to demonstrate I/O operations.
10	Program to demonstrate Network Programming.
11	Program to demonstrate Applet structure and event handling.
12	Program to demonstrate Layout managers.

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. Java / MS Acess/ MySQL, NET Beans / TOMCAT Server - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA301	MOBILE APPLICATION DEVELOPMENT	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

Course Outcomes: Upon the students will be able to Completion of the course,

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS
- Deploy mobile applications in Android and iPone marketplace for distribution
-

UNIT I	INTRODUCTION	12

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II	BASIC DESIGN	12

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III	ADVANCED DESIGN	12

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV	TECHNOLOGY I - ANDROID	12

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V	TECHNOLOGY II - IOS	12

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

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TEXT BOOK(S):	
1.	Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2.	Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.
REFERENCE(S):	
1.	James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.
2.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
3.	Subrahmanyam Allamaraju and Cedric Buest , "Professional Java Server Programming(J2EE 1.3 Edition), ", Shroff Publishers & Distributors Pvt Ltd.
WEB RESOURCE(S):	
1.	http://developer.android.com/develop/index.html
2.	https://nptel.ac.in/courses/105105162/32
3.	https://www.youtube.com/watch?v=3AYoipyqOkQ

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA302	AI AND MACHINE LEARNING	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is

- To understand fundamental concepts in Artificial Intelligence.
- To learn about various searching methods
- To introduce applications of machine learning and case studies
- To provide an insight to different supervised learning techniques, merits and demerits

Course Outcomes: At the end of this course, learners will be able to:

- Gain the advanced data analysis skills
- Create AI/ML solutions for various business problems
- Able to build and deploy production grade AI/ML applications
- Able to apply AI/ML methods, techniques and tools immediate

UNIT I	INTRODUCTION	12

Intelligent Agents – Agents and environments – Good behavior – The nature of environments – structure of agents – Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

UNIT II	SEARCHING TECHNIQUES	12

Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments – Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems – Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

UNIT III	KNOWLEDGE REPRESENTATION	12

Introduction to Logical Agents- First order logic – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining – Resolution – Knowledge representation – Ontological Engineering - Categories and objects.

UNIT IV	INTRODUCTION TO MACHINE LEARNING	12

What and Why? Designing a learning system, Issues. Examples of Machine Learning Applications, Overview: Supervised Learning, Learning Associations, Classification, Regression, Unsupervised learning and Reinforcement Learning.

UNIT V	SUPERVISED LEARNING AND UNSUPERVISED LEARNING	12

Generative vs discriminative learning, Gaussian mixture models, Decision Tree learning, Neural Networks, Support vector machines, Instance based learning, Ensemble learning.
Discovering clusters, Discovering latent factors, Discovering graph structure, Dimensionality reduction, Case Studies: Classification, Regression, clustering and anomaly detection.

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TEXT BOOK(S):	
1.	Stuart Russell, Peter Norvig, —Artificial Intelligence – A Modern Approachǁ, 3rd Edition, Pearson Education / Prentice Hall of India, 2013
2.	Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series" , 3rd Edition, MIT Press, 2014 .
REFERENCE(S):	
1.	Nils J. Nilsson, —Artificial Intelligence: A new Synthesisǁ, Harcourt Asia Pvt. Ltd., 2000.
2.	Elaine Rich and Kevin Knight, —Artificial Intelligenceǁ, 2nd Edition, Tata McGraw-Hill , 2003.
3.	Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals, 1st Edition, Wiley, 2014.
WEB RESOURCE(S):	
1.	https://nptel.ac.in/courses/106105077/
2.	https://nptel.ac.in/courses/106105152/

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA303	INTERNET OF THINGS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino.
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario.

UNIT I	FUNDAMENTALS OF IoT	9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack — Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II	IoT PROTOCOLS	9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT III	DESIGN AND DEVELOPMENT	9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks -Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV	DATA ANALYTICS AND SUPPORTING SERVICES	9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework –Django – AWS for IoT – System Management with NETCONF-YANG.

UNIT V	CASE STUDIES/INDUSTRIAL APPLICATIONS	9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

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TEXT BOOK(S):	
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
2.	Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approachll, Universities Press,
REFERENCE(S):	
1.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsll, Springer, 2011.
2.	Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocolsll, Wiley, 2012 (for Unit 2).
3.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/117106113/-"IoT Basics – 1", Prof.AnandIyerCalypto Design Systems, IIT Madras.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAP03	Soft Skills	1	0	2	3	45	100	

Course Objective (s):

- To develop basic grammar knowledge in English.
- To improve Verbal and Non-verbal Communication Skills.
- To develop Confidence, Emotional Intelligence and Inter Personal Skills
- To train the Students on Group Discussion Do's and Don'ts , on Interview Skills and Presentation Skills.
- To develop Business Etiquette and the importance of Ethics and Values.

Course Outcomes: At the end of this course, learners will be able to:

- Have competent knowledge of grammar with an understanding of its basic grammar.
- Speak and write appropriately applying these rules.
- Communication effectively and enhance their interpersonal relationship building skills with renewed self confidence.
- Face interview, GDs and Presentations.
- Understand and develop the etiquette necessary to present oneself in a professional setting.

UNIT 1	Effective English – Written English and Spoken English	9

Basic rules of Grammar - Parts of Speech – Tenses – Verbs.Sentence Construction.Dialogues and Conversations – Writing. Exercises to practice and improve these skills.
Vocabulary – Idioms & Phrases – Synonyms – Antonyms.Dialogues and Conversations –Writing. Exercises to practice and improve these skills.

UNIT 2	Art of Communication & The Hidden Data Involved	9

Verbal Communication - Effective Communication - Active listening –Paraphrasing – Feedback.

Non Verbal Communication - Body Language of self and others.
Importance of feelings in communication - dealing with feelings in communication.

UNIT 3	World of Teams	9

Self Enhancement - importance of developing assertive skills- developing self confidence – developing emotional intelligence. Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved Working with Groups – Dealing with People- Group Decision Making.

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UNIT 4	Interview Skills, Group Discussion And Presentation Skills	9
	Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback. GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. Presentation Skills –	
UNIT 5	**Business Etiquette & Ethics**	**9**
Grooming etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress.Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.		
	TOTAL : 45(15 Theory +30 Practical) Hours	

REFERENCES:

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA311	MOBILE APPLICATION DEVELOPMENT LABORTORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To design applications using J2EE, Struts and Hypernate.
- To develop a web application with n-tier architecture.
- To develop a simple application using Spring MVC.

Course Outcomes: At the end of this course, learners will be able to:

- Design and develop interactive, client-side, server-side executable web applications.
- Develop a simple online application using Spring MVC
- Create applications using web services such as JSON, WSDL and SOAP.
- Develop a simple database application using ASP .NET

Exp. No.	Name of Experiments
1.	Develop a car showroom inventory web application with 2-tier architecture. Use JSP and JDBC
2.	Develop a real estate web application with n-tier architecture. Use JSP, Servlets and JDBC. The application should be able to add and search all properties such as rental/own, individual/ apartment and duplex/semi-duplex.
3.	Develop any web application which authenticates using LDAP
4.	Develop a standalone java application or a web application to add, modify and delete the LDAP attributes of the given input
5.	Design a student identity management web application using struts framework. The application should be able to provide an identity such as student id, access to department assets with department id, access to lab assets with lab id.
6.	Create an online bookstore that includes all validation controls available in ASP.NET
7.	Create a component that receives two numbers from the user through a Web Form, and based on the user's selection add or subtract the two numbers and returns the result to the Web Form. The result should be displayed in the Web Form using ASP.NET
8.	Create a Silverlight Application for the SharePoint Client Object Model
9.	Create a graph using the SharePoint Object Model and Silverlight Graphing controls

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. Java, Ms-Access, /MYSQL, Net Beans, Glass Fish ServeR - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA312	INTERNET OF THINKS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To design applications using J2EE, Struts and Hypernate.
- To develop a web application with n-tier architecture.
- To develop a simple application using Spring MVC.

Course Outcomes: At the end of this course, learners will be able to:

- Design and develop interactive, client-side, server-side executable web applications.
- Develop a simple online application using Spring MVC
- Create applications using web services such as JSON, WSDL and SOAP.
- Develop a simple database application using ASP .NET

Exp. No.	Name of Experiments
1.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3.	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6.	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9.	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11	To install MySQL database on Raspberry Pi and perform basic SQL queries.
12	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
13	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
15	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

Software Requirements (for a batch of 30 Students)

1. Computers - 30 Nos
2. Arduino/Raspberry - 30 Nos

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA313	MINI PROJECT	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is

- To acquire practical knowledge within the chosen area of technology for project development using comprehensive and systematic approach.
- To contribute as an individual or in a team in development of technical projects.
- To develop effective communication skills for presentation.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the project development life cycle
- Develop the code for available information
- How to implement and debug the project

S. No.	RULES
1	Team Project with a maximum of four in a team
2	Students shall select a domain and develop an application with social relevance
3	Documentation is to be based on the standards
4	Evaluation pattern is like Lab examination
5	Need to submit a report, presentation with demo.
6	User Based Testing and feedback from the benefited society required

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester IV	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CA411	PROJECT WORK	0	0	24	12	60	100	

There shall be three assessments (each 100 marks) during the Semester by are view committee. The Student shall make presentation on the progress made before the Committee. The Head of the Institution shall constitute the review committee for each branch of study. The total marks obtained in the three assessments shall be reduced to 40 marks and rounded to the nearest integer (as per the Table given below). There will be a vice-voce Examination during End Semester Examinations conducted by a Committee consisting of the supervisor, one internal examiner and one external examiner. The internal examiner and the external examiner shall be appointed by the Controller of Examination. The distribution of marks for the internal assessment and End semester examination is given below:

Internal Assessment (40Marks)			End Semester Examination (80 Marks)			
Review I	Review II	Review III	Thesis Submission (30 Marks)	Viva – Voce (Rounded to 50 Marks)		
5	7.5	7.5	External Examiner	Internal Examiner	External Examiner	Supervisor Examiner
			30	15	20	15

The Project Report prepared according to approved guidelines as given by Director, Academic Courses and duly signed by the supervisor(s) and the Head of the Department concerned shall be submitted to the Head of the Institution.

The resubmission of a project report and subsequent viva-voce examination will be considered as reappearance with payment of exam fee. For this purpose the same Internal and External examiners shall evaluate their submitted report.

A copy of the approved Project Report after the successful completion of viva voce examinations shall be kept in the library of the college / institution.

Practical / Industrial Training, Summer Project if specified in the Curriculum shall not exceed the maximum duration of 4 weeks and should be organized by the Head of the Department for every student.

At the end of Practical / Industrial Training, Summer Project the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation for 100 marks will be carried out internally based on this report and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Institution. Certificates submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examination.

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PROFESSIONAL ELECTIVE - I

Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE01	SOFTWARE TESTING AND QUALITY ASSURANCE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into the levels of testing in the user environment
- To understand standard principles to check the occurrence of defects and its removal

Course Outcomes: At the end of this course, learners will be able to:

- Able to test the software by applying various testing techniques.
- Able to debug the project and to test the entire computer based systems at all levels.
- Able to test the applications in the specialized environment using various automation tools
- Able to evaluate the web applications using bug tracking tools.
- Able to apply quality and reliability metrics to ensure the performance of the software

UNIT I	TESTING TECHNIQUES & TEST CASE DESIGN	9

Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and Statebased Testing.

UNIT II	LEVELS OF TESTING	9

The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.

UNIT III	TESTING FOR SPECIALIZED ENVIRONMENT	9

Testing Client / Server Systems – Testing in a Multiplatform Environment - Testing Object Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Quality Aspects – Web Engineering – Testing of Web based Systems. Case Study for Web Application Testing.

UNIT IV	TEST AUTOMATION	9

Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

UNIT V	SOFTWARE TESTING AND QUALITY METRICS	9

Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.

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TEXT BOOK(S):	
1.	Adithya P. Mathur, " Foundations of Software Testing – Fundamentals algorithms and techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008
2.	Dale H. Besterfiled , "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2011).
REFERENCE(S):	
1.	Edward Kit, " Software Testing in the Real World – Improving the Process", Pearson Education, 1995
2.	Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", 3rd Edition, John Wiley & Sons Publication, 2012
WEB RESOURCE(S):	
1.	https://www.youtube.com/watch?v=TGUeeyOtR9k
2.	https://www.youtube.com/watch?v=YmscnVRLwy0

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE02	DATA WAREHOUSING AND DATA MINING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To expose the students to the concepts of Data warehousing Architecture.
- To make the students understand data mining principles and techniques and use it as a cutting edge business intelligence tool.
- To develop the understanding of different types of mining methods and current trends in data mining.

Course Outcomes: At the end of this course, learners will be able to:

- Preprocess the data for mining applications.
- Apply the association rules for mining the data.
- Design and deploy appropriate classification techniques.
- Cluster the high dimensional data for better organization of the data.
- Discover the knowledge imbibed in the high dimensional system.
- Evolve Multidimensional Intelligent model from typical system.
- Evaluate various mining techniques on complex data objects.

UNIT I	DATA WAREHOUSE	9

Data warehouse - Operational Database Systems vs Data Warehouses – Data warehousing Components –Building a Data warehouse — Mapping the Data Warehouse to aMultiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, andTransformation Tools –Metadata – Online Analytical Processing (OLAP).

UNIT II	DATA MINING & DATA PREPROCESSING	9

Data Mining Introduction – Data – Kinds of Data – Data objects and attribute types – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

UNIT III	ASSOCIATION RULE MINING	9

Introduction - Association Rule Mining - Frequent Itemset Mining Methods – Mining Frequent Itemsets with and without Candidate Generation - Pattern Mining in Multilevel, Multidimensional Space - Constraint-Based Frequent Pattern Mining - Pattern Exploration and Application.

UNIT IV	CLASSIFICATION & PREDICTION	9

Classification vs. Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification – Rule Based Classification – Bayesian Belief Networks – Classification by Back Propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT V	CLUSTERING	9

Cluster Analysis – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outliers and Outlier analysis – Outlier detection methods.

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TEXT BOOK(S):	
1.	Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008
2.	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012
REFERENCE(S):	
1.	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007
2.	K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006
3.	G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/106106093/31,"Introduction to Data warehousing and OLAP", Prof. Dr.S.Srinath, Department of Computer Science and Engineering, IIT, Madras
2.	http://nptel.ac.in/courses/106106093/35,"Data mining and Knowledge discovery, Data Mining, Mining for Association rules", Prof. Dr.S.Srinath, Department of Computer Science and Engineering, IIT, Madras

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE03	DIGITAL IMAGE PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To develop the understanding of the techniques involved in human resource management.
- To expose the students to the current development and maintenance strategies of human resources.
- To make the students examine current issues, trends, practices and processes in HRM
- To enable the students to apply management skills and knowledge in a realistic environment.

Course Outcomes: At the end of this course, learners will be able to

- Identify the primary elements of Digital Image Fundamentals
- Outline the components and the goals of Image Enhancement.
- Understand the concept of Image Restoration
- Understand the practices used in Image segmentation
- Able to identify Image Compression techniques

UNIT I	DIGITAL IMAGE FUNDAMENTALS	9

Elements of digital image processing systems, Video on and Digital Camera working principles, Elements of visual perception, brightness, contrast, saturation, mach band effect, color image fundamentals – RGB, HIS models, image sampling, Quantization, dither, Two dimensional Mathematical preliminaries, 2D transforms – DFT, DCT, KLT, SVD.

UNIT II	IMAGE ENHANCEMENT	9

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphism filtering, Color image enhancement.

UNIT III	IMAGE RESTORATIN	9

Image Restoration - degradation model, Unconstrained restoration, Lagrange multiplier and Constrained restoration, Inverse filtering-removal of blur caused by uniform linearmotion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV	IMAGE SEGMENTATION	9

Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and Merging segmentation by morphological water sheds - basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V	IMAGE COMPRESSION	9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, VectorQuantization, Transform coding, JPEG standard, MPEG.

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TEXT BOOK(S):	
1.	Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing', Pearson, Second Edition,2004.
2.	Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson 2002.
REFERENCE(S):	
1.	Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2.	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB',Pearson Education, Inc., 2004.
3.	William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2002
4.	Milan Sonka et al, 'Image Processing , Analysis and Machine Vision', Brookes/Cole, VikasPublishing House, 2nd edition, 1999.
WEB RESOURCE(S):	
1.	http://www.nptel.ac.in/courses/106105032/, "Lecture Series on Digital Image Processing", Prof. P.K. Biswas, I.I.T, Kharagpur.
2.	http://www.nptel.ac.in/courses/117105079/1,"Multidimensional Digital Signal Processing" Dr. P K. Biswas.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE04	MIDDLEWARE TECHNOLOGIES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To provide a sound knowledge in various middleware technologies for distributed applications.
- To introduce application inter-operability, Scalability, and integrate legacy facilities.
- To familiarize the various server concepts and peer-to-peer connectivity.

Course Outcomes: At the end of this course, learners will be able to:

- Understand about the Client/Server concepts
- Design the EJB Architecture
- Building an application with EJB.
- Understand about the CORBA concepts
- Study about implementations in Components.

UNIT I	CLIENT / SERVER CONCEPTS	9

Client – Server – File Server, Database server, Group server, Object server, Web server .Middleware – General middleware – Service specific middleware. Client / Server Building blocks – RPC – Messaging – Peer – to- Peer.

UNIT II	EJB ARCHITECTURE	9

EJB – EJB Architecture – Overview of EJB software architecture – View of EJB –Conversation – Building and Deploying EJBs – Roles in EJB.

UNIT III	EJB APPLICATIONS	9

EJB Session Beans – EJB entity beans – EJB clients – EJB Deployment – Building an application with EJB.

UNIT IV	CORBA	9

CORBA – Distributed Systems – Purpose - Exploring CORBA alternatives –Architecture overview – CORBA and networking model – CORBA object model – IDL – ORB - Building an application with CORBA.

UNIT V	COM	9

COM – Data types – Interfaces – Proxy and Stub – Marshalling – Implementing Server / Client – Interface Pointers – Object Creation, Invocation , Destruction – Comparison COM and CORBA – Introduction to .NET – Overview of .NET architecture – Marshalling – Remoting.

TEXT BOOK(S):

1. Robert Orfali, Dan Harkey and Jeri Edwards, "The Essential Client/Server Survival Guide", Galgotia Publications Pvt. Ltd., 2002.
2. Tom Valesky,"Enterprise Java Beans",Pearson Education, 2002.
3. Jason Pritchard,"COM and CORBA side by side", Addison Wesley,2000

REFERENCE(S):

1. Chris Britton, Peter Bye, "IT Architecture And Middleware, A Staligies For Building Large Integrated System", Addition Wesley, 2004.
2. Jesse Liberty, "Programming C#", 2nd Edition, O'Reilly Press, 2002.
3. N. Wallace, :COM/DCOM Blue Book", Dreamtech Press, 2000.
4. T. J. Mowbray, "Inside CORBA: Distributed Object Standards and Applications", Addison Wesley, 1997.

WEB RESOURCE(S):

1. http://www.cse.wustl.edu/~jain/tutorials/ftp/t_2tcp.pdf
2. http://ftp1.digi.com/support/documentation/0190074_j.pdf

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester II	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE05	MOBILE COMPUTING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge on the GSM, SMS, GPRS Architecture.
- To expose about wireless protocols -WLN, Bluetooth, WAP, Zig Beeissues.
- To introduce the concept of Network, Transport Functionalities of Mobile communication.
- To gain the knowledge of Adhoc and wireless sensor networks.
- To impart the knowledge about Mobile Application Development.

Course Outcomes: At the end of this course, learners will be able to:

- Gain the knowledge about various types of Wireless Data Networks and Voice Networks.
- Understand the architectures, the challenges and the Solutions of Wireless Communication.
- Realize the role of Wireless Protocols in shaping the future Internet.
- Gain the knowledge about Mobile Ad-Hoc and Sensor Networks.
- Able to develop simple Mobile Application Using Android.

UNIT I	Wireless Communication Fundamentals, Architecture	9

Frequencies Spectrum- Multiplexing- Spread spectrum-GSM vs CDMA - 2G Mobile Wireless Services - Comparison of 2G and 3 G - GSM Architecture-Entities-Call Routing-PLMN-Address and identifiers-Network Aspects-Mobility Management-Frequency Allocation-Authentication and Security-SMS Architecture-Value Added Service through SMS-GPRS-GPRS and Packet Data Network-Architecture-Network Operations-Data Service-Application

UNIT II	Mobile Wireless Short Range Networks	9

Introduction-WLAN Equipment-WLAN Topologies-WLAN Technologies-IEEE 802.11 Architecture-WLAN MAC-Security of WLAN, Power Management-Standards- WAP Architecture-WAP 2.0-Bluetoothenabled Devices Network-Layers in Bluetooth Protocol-Security in Bluetooth- IrDA- ZigBee

UNIT III	Mobile IP Network Layer, Transport Layer	9

Introduction-WLAN Equipment-WLAN Topologies-WLAN Technologies-IEEE 802.11 Architecture-WLAN MAC-Security of WLAN, Power Management-Standards- WAP Architecture-WAP 2.0-Bluetoothenabled Devices Network-Layers in Bluetooth Protocol-Security in Bluetooth- IrDA- ZigBee

UNIT IV	Mobile Ad-Hoc, Sensor Networks	9

Introduction to Mobile Ad hoc Network- MANET-Routing and Routing Algorithm-Security – Wireless Sensor Networks-Applications- Distributed Network and Characteristics-Communication Coverage- Sensing Coverage-Localization- Routing -Function Computation- Scheduling

UNIT V	Mobile Application Development	9

Mobile Applications Development -Application Development Overflow-Techniques for Composing Applications - Understanding the Android Software Stack – Android Application Architecture –Developing for Android – The Android Application Life Cycle – The Activity Life Cycle – Creating Your First Android Activity – Creating Applications and Activities – Creating User Interfaces – Intents – Broadcast Receivers – Adapters – Data Storage, Retrieval, and Sharing.-Geo services- creating mobile applications like game, Clock, calendar, Convertor, phone book, Text Editor.

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TEXT BOOK(S):	
1.	Asoke K Talukder, HasanAhmed,Roopa R Yavagal "Mobile Computing", Tata McGraw Hill Publicatons.
2.	Raj Kamal "Mobile Computing" Oxford Higher Education, Second Edition, 2012
REFERENCE(S):	
1.	Vijay K Garg "Wireless Communications & Networking" Morgan Kaufmann Series, 2010.
2.	JochenSchillar "Mobile Communications" Pearson Education second Edition
3.	DonnFelker ,'Android Application Development For Dummies', Wiley, 2010
WEB RESOURCE(S):	
1.	https://onlinecourses.nptel.ac.in/noc16_cs13, "Mobile Communications" by Prof. Pushpendra Singh, Ph.D, IIT Delhi
2.	https://onlinecourses.nptel.ac.in/noc16_cs13/, "Mobile Development Platform" by Dr.Ranjan Bose, IIT Delhi.

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PROFESSIONAL ELECTIVE – II

Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE06	SUPPLY CHAIN MANAGEMENT	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge of revenue and cost.
- To develop the understanding of replenishment of the material or product whenever required
- To gain the knowledge of fulfill the customer demand through efficient resources.

Course Outcomes: At the end of this course, learners will be able to:

- Identify and explore the importance of supply chain management
- Design the supply chain network design
- Design the material flow of retail store
- Understand about the information flow
- Study about innovations in supply chain management

UNIT I	INTRODUCTION	9

Supply Chain – Fundamentals – Decision Phases - Process view - Importance –Competitive and supply chain strategies – Achieving strategic fit – Expanding strategic scope – Drivers of Supply Chain Performance – A framework for structuring drivers. Obstacles to achieving strategic fit.

UNIT II	SUPPLY CHAIN NETWORK	9

The role of distribution – Factors influencing network design – Distribution network – Value distribution – Distribution network in practice. The role of network – Factors influencing network design decisions – Frame work for network design decisions – The impact of globalization on supply chain networks.

UNIT III	MANAGING MATERIAL FLOW	9

Types of inventory – Inventory related costs – Drivers of transportation decisions – Devising a strategy for transportation – Vehicle scheduling – Transportation costs in E-Retailing. Network operations planning – Design problem – Design and operations model – Location of service systems.

UNIT IV	MANAGING INFORMATION FLOW	9

The role of forecasting – Qualitative forecasting – Quantitative methods – Time series forecasting models – Enabling supply chain management through information technology – Strategic management framework for IT adoption in supply chain management – Supply chain management application marketplace future trends.

UNIT V	SUPPLY CHAIN INNOVATIONS	9

Internal integration – External integration – Building partnership and trust in a supply chain – Industry level initiatives – Supply chain mapping – Supply chain process restructuring – Postpone the posint of differentiation. High demand uncertainty environment – Illustration of responsive supply chain approach – supply chain disruptions and its impact to on business.

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TEXT BOOK(S):	
1.	Sunil Chopra and Peter Meindl, Supply Chain Management - Strategy Planning and Operation, PHI Learning / Pearson Education, Third Edition, 2007.
2.	Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 1st Edition, 2009.
REFERENCE(S):	
1.	Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5 th Edition,2007.
2.	Rahul .V. Altekar, Supply chain management concepts and cases, PHI 2005.
3.	Joel D. Wisner, G. Keong Leong, Keah - Choon Tan, Principles of Supply Chain Management - A Balanced Approach, South - Western, Cengage Learning 2008.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/110106045/1 "Operations and Supply Chain Management",Prof. G. Srinivasan", IIT Madras.
2.	https://onlinecourses.nptel.ac.in/noc17_mg12/preview "Supply Chain Analytics", Dr. RajatAgrawal, IIT Roorkee.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE07	HUMAN RESOURCE MANAGEMENT	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To understand the importance of human resources.
- To describe the steps involved in the human resource planning process
- To understand the stages of employee socialization and training needs.
- To know about the purposes of performance management systems and appraisal.
- To know the list of occupational safety and health administration enforcement priorities

Course Outcomes: At the end of this course, learners will be able to:

- Identify the primary external influences affecting HRM.
- Outline the components and the goals of staffing, training and development.
- Understand the selection procedure in various organizations.
- Understand the practices used to retain the employees and able to evaluate their performance.
- Able to identify the stress and the cause of burn out

UNIT I	HRM FRAMEWORK AND PROCUREMENT	9

Introduction to Human Resource Management – Organization culture – Strategic human resource management – framework – evolution and environment of human resource management - Job analysis and design – Human resource planning – Recruitment – Selection – Orientation, Socialization and Placement – Organization and method studies.

UNIT II	HEALTH, SAFETY, SECURITY AND WELFARE	9

Roles and responsibilities under Health and Safety Legislation – Introduction to Occupational Health and Safety - Risk Management – Health and Safety as part of Human Resources Management – Establishing Health and Safety Committees - Safety and security officers – prevention of theft and pilfering – Fire prevention and Firefighting.

UNIT III	HUMAN RESOURCE DEVELOPMENT	9

Career Planning and guidance – Employee Training - Induction – Training and development – Need and benefits of training – Types of training programs – training and development methods – Evaluation of training – Management development – Organizational development.

UNIT IV	HR EVALUATION AND MAINTENANCE	9

Performance evaluation and Job evaluation – Compensation administration – Incentives and benefits - Employee well-being – Employee welfare and Social Security – Worker's participation and empowerment – Job Rotations.

UNIT V	HR INTEGRATION AND CONTROL	9

Industrial relations – Discipline and disciplinary actions – Employee grievances – Industrial disputes and collective bargaining – Trade Unions. Human Resource audit – Human resource information system – Human resources accounting – Ethical issues in Human Resource Management – International Human resource management.

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TEXT BOOK(S):	
1.	Manmohan Joshi, "Human Resource Management", BookBoon, 2013
2.	PravinDurai, "Human Resource Management", Pearson, 2010.
REFERENCE(S):	
1.	Mondy and R.Wayne, "Human Resource Management", 13th Edition, Pearson, 2014.
2.	Anderson.V, "Human Resource Management: Investigating a Business Issue", CIPD,2013.
3.	Mamman.A and Somantri.Y, "What role do HR practitioners play in developing countries", International journal of Human Resource Management,2014.
4.	Anderson.T.J and Minbaeva.D, "The role of human resource management in strategy making", Human Resource Management,2013.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/122105020, "Human Resource Management - I", Prof.KalyanChakravarthi, IIT-Kharagpur.
2.	http://nptel.ac.in/courses/110105069/ , " Principles of Human Resource Management", Prof. A Malik, IIT Kharagpur.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE08	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To expose the importance of information in business
- To gain the knowledge in technologies and methods used for effective decision making in an organization.
- To impart the knowledge on effective applications of information systems in business

Course Outcomes: At the end of this course, learners will be able to:

- Identify and explore the importance of Information System
- Understand about the Information Technologies
- Design the Business Applications
- Developing Business/IT Strategies
- Implementation of Management Challenge issues

UNIT I	INFORMATION SYSTEM	9

Foundation Concepts: Information Systems in Business-The Components of Information Systems-Competing with Information Technology-Fundamentals of Strategic Advantage-Using Information Technology for Strategic Advantage.

UNIT II	INFORMATION TECHNOLOGIES	9

Computer Hardware- Computer Systems- Computer Peripherals-Computer Software-Application Software-System Software – Data Resource Management-Technical Foundations of Database Management- Managing Data Resources-Telecommunications and Networks

UNIT III	BUSINESS APPLICATIONS	9

e-Business Systems-Functional Business Systems-Enterprise Business systems-Enterprise Resource Planning-Supply Chain Management-E-Commerce Systems-Fundamentals-Applications and Issues-Support Decision Making.

UNIT IV	DEVELOPMENT PROCESS	9

Developing Business/IT Strategies-Planning fundamentals-Implementation Challenges-Developing Business/IT Solutions- Developing Business Systems-Implementing Business Systems.

UNIT V	MANAGEMENT CHALLENGES	9

Security and Ethical Challenges- Security, Ethical and Societal Challenges of IT, Security Management of Information Technology-Enterprise and Global Management of Information Technology-Managing Information Technology- Managing Global IT

TEXT BOOK(S):

1. James AO'Brien, George M Marakas, Ramesh Behl, "Management Information Systems", McGraw Hill Education(India) Edition, 2013.

REFERENCE(S):

1. Laudon K.C, Laudon J.P, Brabston M.E, "Management Information Systems -Managing the digital firm", Pearon Education, 2004.
2. Jeffrey A.Hoffer, Joey F.George, Joseph S. Valachich, "Modern Systems Analysisand Design", Third Edition, Prentice Hall, 2002.

WEB RESOURCE(S):

1. http://www.nptel.ac.in/courses/122105022/ "Management Information System",Prof. BiswajitMahanty, IIT, Kharagpur.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE09	PROFESSIONAL ETHICS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge and identify the standards of professionalism and ethical behavior.
- To introduce the students to social network and computer accessibility issues.
- To expose to safety measures to computer crimes.

Course Outcomes: At the end of this course, learners will be able to:

- Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology
- Able to envision the societal impact on the products/ projects they develop in their career
- Understanding the code of ethics and standards of computer professionals
- Analyze the professional responsibility and empowering access to information in the work place.

UNIT I	HUMAN VALUES AND COMPUTER ETHICS	9

Morals, Values and ethics – Service Learning – Work Ethic – Courage – Self Confidence – Character – Respect for others – Stress Management. Overview of Computer Ethics – Identifying ethical issue - Ethics and Law – Ethical Theories – Professional code of conduct.

UNIT II	ENGINEERING ETHICS AND COMPUTER HACKING	9

Senses of engineering ethics - Variety of Moral Issues - Types of inquiry - Moral Dilemmas Moral Autonomy - Models of Professional Roles - Theories about Right Action - Self-Interest - Customs and Religion . Computer hacking – Introduction – definition of hacking – Destructive programs – hacker ethics - Professional constraints – BCS code of conduct – Ethical positions on hacking.

UNIT III	COMPUTER CRIME AND SAFETY	9

Computer crime - Introduction - computer security measures – Professional duties and obligations - Intellectual Property Rights – Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues Copyright - Ethical and professional issues – free software and open source code Safety and Risk - Assessment of safety and Risk - Risk Benefit Analysis and Reducing Risk - The Three Mile Island. and Chernobyl Case Studies.

UNIT IV	COMPUTER TECHNOLOGIES AND ACCESSIBILITY ISSUES	9

Introduction – Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace – Software Development – strategies for engineering quality standards – Use of Software, Computers and Internet-based Tools -Documentation Authentication and Control – Software engineering code of ethics and practices – Quality management Standards.

UNIT V	SOCIAL NETWORKING AND GLOBAL ISSUES	9

Social Networking – Company owned social network web site – the use of socialnetworks in the hiring process – Social Networking ethical issues – Cyber bullying – cyber stalking – Online virtual world – Crime in virtual world - digital rights management - Online defamation – Piracy – Fraud Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers - Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Corporate

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TEXT BOOK(S):	
1.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2.	Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical, legal and professional issues in computing", Middlesex University Press, 2008.
REFERENCE(S):	
1.	John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
2.	Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd.,New Delhi 2013.
3.	R.R.Gaur, R.Sangal, G.P.Bagaria, "A foundation course in Human Values and Professioanl Ethics" Excel books, 2010.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/109104068/38, "Exploring Human Values: Visions of Happiness and Perfect Society (Web)", Prof. A.K. Sharma, IIT Kanpur.
2.	http://nptel.ac.in/courses/122102007/, "Management Science I", Prof. AnuradhaSharma,IIT Delhi.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE10	ENTERPRISE RESOURCE PLANNING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge on of the fundamental concepts of ERP systems.
- To expose the architecture and working of different modules in ERP.
- To familiarize the activities of ERP Project Management cycle

Course Outcomes: At the end of this course, learners will be able to:

- Understand the main concepts of ERP.
- Outline the components ERP Implementation.
- Understand the design of Business modules
- Understand the practices used to SAP
- Able to identify Turbo Charges the ERP System

UNIT I	INTRODUCTION TO ERP	9

Overview – Benefits of ERP – ERP and Related Technologies – Business Process Reengineering – Data Warehousing – Data Mining – On–line Analytical Processing –Supply Chain Management.

UNIT II	ERP IMPLEMENTATION	9

Implementation Life Cycle – Implementation Methodology – Hidden Costs – Organizing Implementation – Vendors, Consultants and Users – Contracts – Project Management and Monitoring.

UNIT III	BUSINESS MODULES	9

Business Modules in an ERP Package – Finance – Manufacturing – Human Resource – Plant Maintenance – Materials Management – Quality Management – Sales and Distribution.

UNIT IV	ERP MARKET	9

ERP Market Place – SAP AG – PeopleSoft – Baan Company – JD Edwards World Solutions Company – Oracle Corporation – QAD – System Software Associates.

UNIT V	ERP – PRESENT AND FUTURE	9

Turbo Charge the ERP System – EIA – ERP and E–Commerce – ERP and Internet – Future Directions in ERP.

TEXT BOOK(S):

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, Third Edition 2007.
2. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, "Concepts in Enterprise Resource Planning" , Thomson Learning, Third Edition, 2001.

REFERENCE(S):

1. Vinod Kumar Garg and N.K .Venkata Krishnan, "Enterprise Resource Planning –concepts and Planning", Prentice Hall, 2nd Edition 1998.
2. Jose Antonio Fernandz, " The SAP R /3 Hand book", Tata McGraw Hill, 3rd Edition 2005

WEB RESOURCE(S):

1. http://www.academictutorials.com/erp/
2. http://www.exforsys.com/tutorials/erp.html

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PROFESSIONAL ELECTIVE – III

Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE11	SERVICE ORIENTED ARCHITECTURE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To know the basic principles of service oriented architecture, its components and techniques
- To understand the architecture of web services
- To design and develop web services using protocol
- To acquire the fundamental knowledge of cloud computing

Course Outcomes: At the end of this course, learners will be able to:

- Able to know the structure of XML and to design and store data in XML
- Able to apply SOAP, HTTP and UDDI services in the web applications
- Able to apply SOA architecture and the underlying design principles for the web projects
- Able to understand the role of SOA in J2EE and .NET
- Able to know the cloud computing architecture and the types of clouds

UNIT I	SOA BASICS	9

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed Internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation – Service Layers.

UNIT II	XML AND WEB SERVICES	9

XML structure – Elements – Creating Well-formed XML - Name Spaces – Schema Elements, Types, Attributes – XSL Transformations – Parser – Web Services Overview – Architecture.

UNIT III	WSDL, SOAP and UDDI	9

WSDL - Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments – UDDI.

UNIT IV	SOA IN J2EE AND .NET	9

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries(JAXR) - Java API for XML based RPC (JAX-RPC) – JAXP-JAX-RS SOA support in .NET – ASP.NET web services.

UNIT V	CLOUD COMPUTING	9

Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry.

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TEXT BOOK(S):	
1.	Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2006.
2.	Heather Williamson, "XML, The Complete Reference", McGraw Hill Education, 2012.
3.	Frank. P. Coyle, "XML, Web Services And The Data Revolution", Pearson Education,2002.
4.	Richard Monson-Haefel, "J2EE™ Web Services", Pearson Education,2007.
5.	RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", McGraw Hill Education, 2013.
REFERENCE(S):	
1.	SandeepChatterjee, James Webber, "Developing Enterprise Web Services. An Architect's Guide", Pearson Education, 2005.
2.	Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
3.	Dan woods and Thomas Mattern, "Enterprise SOA designing IT for Business Innovation", O'REILLY, First Edition, 2006.
WEB RESOURCE(S):	
1.	https://www.slideshare.net/Zubin67/lecture-notes-for-soa "Service oriented Computing and Service Oriented Architecture", W.T. Tsai, Arizona State University

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE12	CLOUD COMPUTING AND BIG DATA ANALYTICS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To gain knowledge of the strengths and limitations of cloud computing.
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To know how to apply suitable virtualization concept.
- To understand big data analytics as the next wave for businesses looking for competitive advantage.
- To explore tools and practices for working with big data.

Course Outcomes: At the end of this course, learners will be able to:

- Compare the strengths and limitations of cloud computing.
- Identify the architecture, infrastructure and delivery models of cloud computing.
- Work with big data platform and understand the fundamentals of various big data analysis techniques.
- Analyze the big data analytic techniques for useful business applications..
- Explore the applications of Big Data.

UNIT I	CLOUD ARCHITECTURE AND MODE	9

Cloud Computing Overview –Origins of Cloud computing –Cloud components -Essential characteristics –Cloud Benefits –Cloud Deployment Model: Public Clouds –Private Clouds –Community Clouds -Hybrid Clouds -Advantages of Cloud Computing.

UNIT II	VIRTUALIZATION	9

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

UNIT III	CLOUD RESOURCES MANAGEMENT AND ISSUES	9

Cloud architecture: Cloud delivery model,Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers –Google App Engine, Salesforce.com and googleplatfrom –Benefits –Operational benefits -Economic benefits –Evaluating SaaS –Platform as a Service(PaaS): PaaS service providers –Right Scale –Salesforce.com –Rackspace –Force.com –Services and Benefits –Infrastructure-as-a -Service (IaaS): IaaS Service Providers –Amazon EC2 –GoGrid

UNIT IV	INTRODUCTION TO BIG DATA	9

Analytics –Nuances of big data –Value –Issues –Case for Big data –Big data options Team challenge –Big data sources –Acquisition –Nuts and Bolts of Big data. Features of Big Data -Security, Compliance, auditing and protection-Evolution of Big data –Best Practices for Big data Analytics -Big data characteristics -Volume, Veracity, Velocity, Variety –Data Appliance and Integration tools –Greenplum –Informatica.

UNIT V	FRAMEWORKS AND APPLICATIONS	9

IBM for Big Data –Map Reduce Framework -Hadoop –Hive –Sharding –NoSQL Databases -S3 -Hadoop Distributed file systems –Hbase –Impala –Analyzing big data with twitter –Big data for E-Commerce –Big data for blogs.

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TEXT BOOK(S):	
1.	Anthony T.Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing A Practical Approach", Tata-McGraw-Hill , New Delhi–2010.
2.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
REFERENCE(S):	
1.	Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure",Wiley India,2011.
2.	Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing",Wiley – India, 2010.
3.	Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big data –The big data platform", McGraw Hill, 2012.
WEB RESOURCE(S):	
1.	http://nptel.ac.in/courses/106106129/28 "Cloud Computing", Prof. V. Kamakoti, IIT, Madras.
2.	http://nptel.ac.in/courses/110106064/" Introduction to Data Analytics", Prof. NandanSudarsanam and Prof. B. Ravindran, IIT, Madras.

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE13	DATABASE TUNING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To impart the knowledge on the significance of database tuning.
- To provide familiarity with query optimization for tuning databases.
- To gain the knowledge about the tuning based E-commerce applications.

Course Outcomes: At the end of this course, learners will be able to:

- Identify and explore the importance of Database tuning
- Design the architecture for an Data structure
- Design the optimizing indexes
- Design the Trouble Shooting methods for Database tuning.
- Implementation of Tuning E-Commerce Applications

UNIT I	INTRODUCTION	9

Review of Relational Databases –Relational Algebra -Locking and Concurrency Control –Correctness Consideration –Lock Tuning –Logging and the Recovery Subsystem –Principles of Recovery –Tuning the Recovery Subsystem –Operating Systems Considerations –Hardware Tuning.

UNIT II	OPTIMIZING INDEXES	9

Types of Queries-Data Structures -B-tree -B+ Tree –Hash Structures –Bit Map Indexes –Clustering Indexes –Non Clustering Indexes –Composite Indexes –Hot Tables –Comparison of Indexing and Hashing

UNIT III	QUERY OPTIMIZATION	9

Tuning Relational Systems –Normalization –Tuning Normalization –Clustering Two Tables –Aggregate Maintenance –Record Layout –Query Tuning –Triggers –Client Server Mechanisms – Objects – Application Tools and Performance –Tuning the Application Interface –Bulk Loading Data –Accessing Multiple Databases.

UNIT IV	TROUBLESHOOTING	9

Query Plan Explainers–Performance Monitors –Event Monitors –Finding Suspicious Queries –Analyzing a Query's Access Plan –Profiling a Query Execution –DBMS subsystems –Data Ware housing Tuning.

UNIT V	CASE STUDIES	9

Tuning E-Commerce Applications –E-Commerce Architecture –Tuning E-Commerce Architecture - Transaction Chopping –Time Series Databases –Understanding Access Plans –Configuration Parameters –Oracle -SQL Server -DB2UDB –Distributed Database -Implementation.

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TEXT BOOK(S):	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", McGraw Hill, 6th Edition, 2011. (Unit 1).
2.	Dennis Shasha and Philippe Bonnet, "Database Tuning, Principles, Experiments, and Troubleshooting Techniques", Morgan Kaufmann, An Imprint of Elsevier, 2005.
REFERENCE(S):	
1.	Mittra, Sitansu S, "Database Performance Tuning and Optimization Using Oracle" Springer, 2003.
2.	Bill Padfield, Darl Kuhn, Sam R. Alapati, "Oracle Database 12c Performance Tuning Recipes: A Problem-Solution Approach", APress, December 2013.
3.	M.TamerOzsu, Patrick Valduriez and S.Sridhar, "Principles of Distributed Database Systems", Pearson Education, 2007.
4.	Thomas Connoly and CarlolynBegg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2003.
WEB RESOURCE(S):	
1.	http://www.nptelvideos.in/2012/11/database-management-system.html, "Database Management Systems", Prof.D.Janakiram, Department of Computer Science and Engineering, IIT Madras/ Dr. S. Srinath, IIIT Bangalore.
2.	https://www.youtube.com/watch?v=v8Ach7-ugDY,"Query Optimization – Database Management Systems", Prof.S.Sudarshan, Department of Computer Science and Engineering, IIT, Bombay

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE14	SOFTWARE RELIABILITY ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To familiarize the concepts of reliability
- To expose the issues in system and models
- To expose about design for reliability
- To expose the concept of design for maintainability
- To provide the challenges and optimization of system reliability

Course Outcomes: At the end of this course, learners will be able to:

- Construct the reliability engineering
- Gain Knowledge about system models concepts
- Understand about principles of reliability
- Able to design computer based maintainability
- Gain Knowledge about optimization of system reliability

UNIT I	CONCEPTS OF RELIABILITY	9

Definition of reliability – reliability Vs quality-reliability function-MTTF – hazard rate function- bathtub curve – derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution. Serial configuration – parallel configuration.

UNIT II	SYSTEM AND MODELS	9

Combined series parallel systems – system structure function, minimal cuts and minimal paths – Markov analysis – load sharing systems, standby system, degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure models.

UNIT III	DESIGN FOR RELIABILITY	9

Reliability design process – system effectiveness – economic analysis and life cycle cost – reliability allocation – optimal, Arinc, Agree, – Design methods – parts and material selection, derating, stress-strength analysis – failure analysis – identification of failure mode – determination of causes –assessment of effects – classification of seventy – computation of critically index – corrective action – system safety and FTA. Analysis of downtime – the repair time distribution – stochastic point processes – system repair time –

UNIT IV	DESIGN FOR MAINTAINABILITY	9

Reliability under preventive maintenance – state dependent systems with repair – MTTR-mean system downtime – MTR – MH/OH – cost model – fault isolation and self diagnostics – repair Vs replacement – replacement model –proactive,preventive,predictive maintenance – maintenance and spares provisioning – maintainability prediction and demonstration – concepts and definition of availability.

UNIT V	OPTIMIZATION OF SYSTEM RELIABILITY	9

Optimization techniques for system reliability with redundancy – heuristic methods applied to optimal system reliability- redundancy allocation by dynamic programming – reliability optimization by non linear programming.

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TEXT BOOK(S):	
1.	Charles E. Ebling, "An introduction to Reliability and Maintainability Engg", Tata McGraw-Hill, 2000.
2.	Patrick D T o'connor, "Practical Reliability Engineringt", John-Wiley and Sons inc, 2002.
REFERENCE(S):	
1.	David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, 2002.
2.	Way kuo, Rajendra Prasad V, Frank A and Tillman, ching- lai Hwang "Optimal Reliability Design and Applciations", Cambridge University Press P ltd., 2001.
3.	Oleg Vinogradov, "Introduction to Mechanical Reliability: A Designers Approach, Hemisphere Publications, 1991.
WEB RESOURCE(S):	
1.	https://www.youtube.com/watch?v=TNJ5eXpege0
2.	https://www.youtube.com/watch?v=2jXCn7q2wEI

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Department	MASTER OF COMPUTER APPLICATIONS					R 2020	Semester III	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
20CAE15	BLOCK CHAIN TECHNOLOGY	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To understand basic concepts of problems and models
- To identify the cryptographic concepts
- To articulate design issues in the mining and bitcoin
- To understand about Ethereum Virtual Machine
- To Know about protocols in Blockchain

Course Outcomes: At the end of this course, learners will be able to:

- Identify and explore the importance of block chain
- Design the architecture for cryptographic concepts
- Design the building blocks of bitcoin
- Identify about Ethereum Virtual Machine
- Implementation of protocols in blockchain

UNIT I	FUNDAMENTS OF BLOCK CHAIN MODELS	9

The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

UNIT II	CRYPTOGRAPHIC CONCEPTS	9

cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography

UNIT III	MECHANICS OF BITCOIN	9

Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.

UNIT IV	ETHEREUM VIRTUAL MACHINE CONCEPTS	9

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts

UNIT V	VARIOUS PROTOCOLS IN BLOCKCHAIN	9

Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for knowledge (SNARK) - pairing on Elliptic curves - Zcash.

TEXT BOOK(S):

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

REFERENCE(S):

1. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOI 9057
2. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017
3. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017

WEB RESOURCE(S):

1. https://www.investopedia.com/terms/b/blockchain.asp
2. https://www.udemy.com/tutorial/build-blockchain/what-is-the-blockchain-and-why-use-it/

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